

Fine-tuning the activity of oxygen evolution catalysts - DTU Orbit (08/11/2017)

Fine-tuning the activity of oxygen evolution catalysts: The effect of oxidation pre-treatment on size-selected Ru nanoparticles

Water splitting is hindered by the sluggish kinetics of the oxygen evolution reaction (OER). The choice of materials for this reaction in acid is limited to the platinum group metals; high loading required of these scarce and expensive elements severely limit the scalability of such technology. Ruthenium oxide is among the best catalysts for OER, however the reported activity and stability can vary tremendously depending on the preparation conditions and pre-treatment. Herein, we investigate the effect of oxidation treatment on mass-selected Ru nanoparticles in the size range between 2 and 10 nm. The effect of two distinct oxidation pre-treatments on the activity and stability have been investigated: (1) thermal oxidation; and (2) oxidation with an oxygen plasma under vacuum. We report that activity and stability can be tuned by using different oxidation pre-treatments. Thermally oxidized particles exhibited the lowest activity, although over an order of magnitude higher than the state of the art, and the highest stability. Plasma-treated particles showed intermediate performance between as-deposited and thermally oxidized NPs.

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